Engineering

A COMPARATIVE STUDY OF PROTON EXCHANGE MEMBRANE AND DIRECT METHANOL FUEL CELLS

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With the world's supply of fossil fuels steadily decreasing, there has become a need to search for alternate methods of producing energy. One method that has become increasingly more popular is the use of fuel cells. Fuel cells function by the reverse hydrolysis of water. Essentially, the fuel provided to the fuel cell is broken down into protons (H^+ ions) and electrons at anode. The protons are then passed to the cathode, while the electrons are used to create an electrical current. Once the protons and the electrons both arrive back at the cathode, they are combined with oxygen (0_2) to form water and other byproducts (depending on which compound is used as the fuel for the cell). There are many different types of fuel cells, and each has its pros and cons. These types of fuel cells include direct methanol fuel cells (DMFCs, phosphoric acid fuel cells, alkaline fuel cells, and proton exchange membrane (PEM) fuel cells. In the present study, two commercially available fuel cells were tested: 1) a PEM fuel cell, and 2) a DMFC. This study involved the comparison of power output as a function of the flow rate of hydrogen (the fuel used to power the PEM cell), power output as a function of molar concentration of the methanol solution (the fuel used to power the DMFC), and the power output as a function of temperature (performed using the PEM fuel cell). For a given flow rate of hydrogen, molar concentration of the methanol solution, and temperature, the power output was maximum for a characteristic current (I_P). The maximum power output was found to increase with temperature, as well as with molar concentration of the methanol solution in the DMFC. In addition, the power output was found to be weakly dependant on the flow rate of hydrogen to the PEM fuel cell. A more accurate study of the flow rate dependence is being conducted.

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